Intraventricular Dissociation due to Complete Intraventricular Block*

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Intraventricular dissociation due to intraventricular block occurred in a patient with cardiac arrest due to massive cerebral hemorrhage. The electrocardiogram showed complete atrioventricular block with three different types of accelerated ventricular rhythm. The ectopic beats did not interfere with each other because of the existence of an area of complete block surrounding the areas in which impulse formation occurred. Hence, the corresponding QRS complexes did not result from depolarization of all the ventricular muscle mass but only of certain regions. The latter were large enough to produce ventricular complexes of enough size to be recorded at the body surface. This phenomenon is the clinical counterpart of the multiple isolated focal contractions which may be seen directly in the ventricles of dying hearts.

Dissociation, that is, the coexistence of two independent rhythms, is not a primary process per se, but rather the consequence of other processes. That dissociation can occur between any two parts of the heart is well recognized. Although intraventricular dissociation due to second degree intraventricular block has been described, to our knowledge the case presented in this communication is the first reported example of intraventricular dissociation produced by complete intraventricular block.

**Description of Electrocardiograms**

Figures 1 to 3 are selected strips obtained during an irreversible cardiac arrest occurring in a patient with massive cerebral hemorrhage. A 12-lead ECG recorded three days previously had shown only regular sinus rhythm with nonspecific ST-T changes. Complete atrioventricular block with an unstable ectopic ventricular rhythm (with rates ranging between 50/min and 72/min) is seen in Figure 1. For didactic reasons, these QRS complexes will be referred to as type A. The small P waves were hardly seen, because the strips were inadvertently recorded at half standardization (1 mv = 5 mm). However, the atrial deflections can be adequately identified in Figure 2, which is a magnification of a part of the top strip in Figure 1.

In the second strip of Figure 1, these type A complexes (now at a rate of 87/min) coexist with another ectopic ventricular rhythm discharging at a rate of 75/min. These M-shaped (type B) complexes are dissociated from the previously mentioned type A beats. But in contrast to what usually occurs in patients with double ectopic ventricular rhythms, the type A and type B complexes are able to stimulate parts of the ventricles even when falling on the portion of the cycle corresponding (in the surface leads) to the effective refractory periods of each other (Fig 3). Hence, true fusion beats were not present, because their occurrence implies that ventricular activation, although a function of both ectopic rhythms, is extinguished by physiologic collision of impulses. The latter can take place at different parts of the ventricles.

On the contrary, Figure 3 (a magnification of the terminal part of the second strip in Figure 1) shows a specific type of pseudofusion beats due to the ECG superimposition of two different QRS complexes which do not interfere with each other because of pathologic conduction block occurring (presumably) around the corresponding foci.

Finally, in the bottom strip of Figure 1, type B ventricular complexes coexist with a third (ectopic) ventricular rhythm (type C). These wide Rs complexes occur at rates between 60/min and 75/min. Again, as in the middle strip, the QRS complexes do not interfere with each other even when falling on the effective refractory period. This indicates that the impulses from one area were unable to reach the part of the ventricular muscle activated by the other beats.

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**Figure 1.** Intraventricular dissociation due to intraventricular block. There are three types of QRS complexes which do not interfere with each other even when appearing during effective refractory period. Tracings were obtained at half standardization (1 mv = 5 mm).

**Figure 2.** Magnification of part of top strip in Figure 1 showing complete atrioventricular block and type A ectopic ventricular complexes.

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DISCUSSION

It is a fundamental law of clinical electrocardiography that ventricular beats cannot arise during the effective refractory period. The latter roughly extends up to the apex of the T wave. This is clearly seen in patients in whom a regular sinus rhythm coexists with an iatrogenic (pacemaker-induced) ventricular parasystole. The artificial stimuli cannot produce a propagated response (recorded at the body surface), because the whole ventricular muscle mass has been rendered effectively refractory by the previous depolarization. The refractoriness detected by the surface leads is a composite of all the ventricular muscle.

However, an impulse can, because of the presence of complete intraventricular block, be confined to an area large enough to produce a QRS complex which will not reflect the electric activity of the total muscle mass but only that of the particular area to which it is confined. In the patient with irreversible cardiac arrest described in this report, intraventricular conduction was so deranged that simultaneously occurring ectopic ventricular rhythms were able to activate certain areas of the ventricles while failing to reach other ventricular regions. Thus, intraventricular dissociation was probably the result of multiple areas of intraventricular block. The arrhythmia shown in Figures 1 to 3 may be the clinical counterpart of the isolated focal contractions which may be directly seen in the ventricles of dying animals (Fig 304 of Katz and Pick). This phenomenon has been attributed to the profound hypoxia and added metabolic alterations developing in the dying heart (Fig 304 of Katz and Pick).

It is also in keeping with the experimental studies of Boineau and Cox* and of Waldo and Kaiser,* who observed the existence of local nonpropagated areas of ventricular activation in experimental myocardial infarction. In these experiments, local depolarization was prevented from producing a propagated response by the effective refractory period of the surrounding (unaffected) myocardium. In fact, when the impulses outlived the duration of the refractory period, an extrasystole (that is, a propagated response depolarizing the totality of the ventricles) resulted.

REFERENCES

3 Pick A: Mechanisms of cardiac arrhythmias from hypothesis to physiological fact. Am Heart J 86:249, 1973

Chronic Granulomatous Disease of Childhood
An Unusual Cause of Honeycomb Lung

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The clinical, physiologic, and pathologic study of a case of chronic granulomatous disease of childhood is described, in which the pulmonary manifestations are those of honeycomb lung.

Diffuse interstitial fibrosis with honeycombing has been described in association with a number of disease states. We recently studied a patient with chronic granulomatous disease of childhood who demonstrated diffuse interstitial fibrosis with honeycombing. To our knowledge, this association has not been previously recorded. It is our purpose to describe the clinical, physiologic, and pathologic features of this case.

Case Report

The patient, an 18-year-old black man, was first seen at Rainbow Babies and Children's Hospital of Cleveland at six years of age for evaluation of chronic bilateral nodular infiltrates and left hilar adenopathy. He had suffered from...